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48-INCH CAST IRON FORCE MAIN FOR ATLANTIC CITY, NEW JERSEY

By L. VAN GILDER

During the eight years of the writer's superintendency of the Atlantic City Water Department it has been his duty to design two forcing mains from the pumping station on the mainland across the intervening salt marsh to the city, a distance of about 26,000 feet.

A description of the first main was printed in the 1912 *Proceedings* of this Association and needs no further mention except to say that it is practically the city's sole dependence at this time and that it bids fair to fulfill the original expectation as to durability.

The second main, 48-inch cast iron, now building, is the subject of this paper.

To prevent the corrosive action of the salt marsh it was deemed advisable to elevate the main above the surface, a suitable foundation being the only obstacle.

The surface strata consist of soft muck of a depth varying from 5 feet to 25 feet constantly saturated with water to the grass roots and underlaid with sand, gravel and clay.

While this muck rapidly destroys iron and steel it is a preservative of wood and, therefore, particularly adapted for the use of pile foundations, provided the piles are not exposed to the atmosphere above the point of constant saturation.

The finished foundation consists of a double row of pine piles freshly cut from growing timber driven in pairs 3 feet 6 inches centers transversely and approximately 6 feet centers longitudinally. Each pair of piles is capped with a reinforced concrete bolster cover to fit the pipe, the bottom of the bolster being in breeching form to surround the piles and carried well below atmospheric action.

By this arrangement every length of pipe is carried on two bolsters supported by four piles.

The bottom is so irregular that the piles vary in length from 20 to 45 feet, the weight of the hammer being sufficient to sink a large proportion of them from 20 to 25 feet without a blow and others requiring a water jet to set them deep enough for lateral stability.



To provide for expansion and contraction due to temperature changes each spigot is held not less than $\frac{1}{4}$ inch clear of the bell shoulder by inserting a gauge ring in the joint; all gauges are withdrawn after the pipes are placed in permanent position. All joints are poured with molten lead not less than 3 inches deep and thus every pipe is carried on its own bolsters and is connected to adjoining pipes only by the lead joint rings.

As a safeguard against any possible chemical action between cast iron and concrete a $\frac{3}{16}$ -inch gasket of hard fiber is placed between pipe and bolster.

Valves, manholes and blow-offs are placed at intervals of about 3000 feet to facilitate internal inspection and repair.

At the city end the main crosses a navigable stream about 500 feet wide with a 200-foot channel 12 feet deep at mean low tide.

This crossing will be made by a 48-inch bell and spigot inverted siphon with flexible joints at all deflection points, all laid on piling with timber caps. The entire structure to be below the present stream bed.

The bottom is beach sand and a 12-inch cast iron pipe 30 years old just removed from the same location is hard and in good condition.

The construction of this main contained so many uncertainties that it was deemed expedient to build it sectionally. The work was so successfully accomplished that the contract for the balance, except the thoroughfare siphon, was let November 6, 1913.

Every part of the work is being prosecuted with such vigor that we expect to have the main in service early in August of this year.

The anticipated difficulties have so far proven to be imaginary rather than real.

The piling has not exceeded the estimate and the proximity of the Pennsylvania and Reading Railroads has so facilitated the handling of materials that by the use of a work train and railroad derrick, pipe, piling, gravel, sand, cement, etc., have been distributed at the approximate cost of handling on the city streets.

The cost of the finished main will approximate \$415,000 and the experience gained in building the first and smaller section together with a closer price for pipe, specials and valves has resulted in a net saving of about \$65,000 in the cost of the last section, assuming that the unit prices in the first contract would have been the same had the whole project been included in the first letting while the cost per foot of main complete, including valves, valve housings, special castings and thoroughfare siphon will be about \$16.



The original 6000 feet was completed early in October, 1913, and has stood empty since completion and test. As no serious disturbance is apparent in the joints we feel warranted in the assumption that ample provision has been made for temperature stresses.

The question has been asked "Why is it necessary to build a new main at this time if the wood stave main is successfully performing the work for which it was intended?"

The pumping station is located 5 miles from the city and the force mains must of necessity be built for the greater part of their length across salt marsh, under one or more railroads and across a navigable stream.

The chances of accident are too great to be ignored and the city cannot afford at any cost to have its water supply cut off.

Two of the old mains are abandoned and the third (20-inch cast iron) has so nearly outlived its usefulness that it has broken three times since work was begun on the last contract.

With the completion of the new main the city will be supplied by two independent lines, either of which will carry the load alone for a number of years to come, that cross railroads and streams on different rights-of-way and that will require two accidents in different locations simultaneously or in quick succession to cause the slightest danger.